

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

ISAAC FARR

Serial No. : 10/632,081

Filed : July 30, 2003

For : PRINTING DEVICE HAVING A PRINTING FLUID DETECTOR

Commissioner for Patents  
P. O. Box 1450  
Alexandria, Virginia 22313-1450

HP Docket No. 10019128-1

Examiner L. Liang

Group Art Unit 2853

Sir:

**DECLARATION UNDER § 1.131**

I declare as follows:

1. I am an inventor who, on July 30, 2003, filed the above-identified application. At the time of such invention, I was an employee of Hewlett-Packard Company.

2. Prior to April 28, 2003, the effective date of the application from which U.S. Patent Application Publication No. 2004/0223021A1 issued to Farr et al. matured, I conceived of my invention, and diligently worked toward reducing my invention to practice, as demonstrated by the Invention Disclosures attached to this declaration.

3. Invention Disclosure 10019128 (which has a descriptive title "Ink Level Sensing for Ink Supplies using the Electrical Double Layer Phenomenon Established within Conductive Polymers") is attached hereto as Exhibit 1. As indicated, Invention Disclosure 10019128 was prepared at least as early as July 23, 2001.

4. Invention Disclosure 10019148 (which has a descriptive title "A Chemically Compatible Conductive Coating/Tubing to Enable Out-of-ink Sensing in Inkjet Supplies") is attached hereto as Exhibit 2. As indicated, Invention Disclosure 10019148 was prepared at least as early as July 23, 2001.

5. At the time of preparing Exhibits 1 and 2, which preceded April 28, 2003, I had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is fluidically connected to the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, wherein at least one of the first electrode and the second electrode includes an electrically conductive coating disposed over an electrically conductive substrate, and wherein the substrate is made at least partially of a material selected from the group consisting of stainless steel, gold, palladium, activated carbon, carbon black, carbon fiber cloth, graphite, glassy carbon, carbon aerogel, and cellulose-derived foamed carbon.

6. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is fluidically connected to the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid

detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, wherein at least one of the first electrode and the second electrode includes an electrically conductive coating disposed over an electrically conductive substrate, and wherein the electrically conductive coating is permeable to printing fluid and is configured to increase the effective surface area of the electrode accessible to the printing fluid.

7. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is fluidically connected to the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, and wherein at least one of the first electrode and the second electrode includes an electrically conductive coating made at least partially from an electrically conductive polymer, and disposed over an electrically conductive substrate.

8. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is fluidically connected to the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact

with the printing fluid, and wherein at least one of the first electrode and the second electrode includes an electrically conductive coating resistant to corrosion by printing fluid, and disposed over an electrically conductive substrate.

9. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is in fluid communication with the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, wherein at least one of the first electrode and the second electrode includes an electrically conductive coating disposed over an electrically conductive substrate, and wherein the electrically conductive coating includes a plurality of interior surfaces contactable by the printing fluid.

10. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is in fluid communication with the printing fluid reservoir; and a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, and wherein at least one of the first electrode and the second electrode includes an electrically conductive coating at least partially made of a

polymer permeable to printing fluid, the electrically conductive coating being disposed over an electrically conductive substrate.

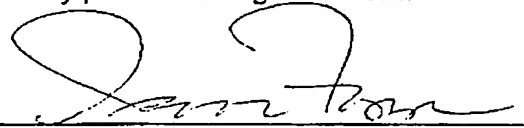
11. I also had conceived of a printing device configured to print a printing fluid onto a printing medium, the printing device including: a printing fluid reservoir configured to hold a volume of the printing fluid; a print head assembly configured to transfer the printing fluid to the printing medium, wherein the print head assembly is in fluid communication with the printing fluid reservoir; a printing fluid detector configured to detect a characteristic of the printing fluid, wherein the printing fluid detector includes a first electrode and a second electrode configured to be in contact with the printing fluid, and wherein at least one of the first electrode and the second electrode includes an electrically conductive coating permeable to printing fluid disposed over an electrically conductive substrate; and an electrically conductive protective coating disposed between the electrically conductive substrate and the electrically conductive coating permeable to printing fluid, wherein the protective coating is at least partially made of a TEFLON material.


12. Following my conception prior to April 28, 2003, I diligently worked toward reducing my inventions to practice, and on July 30, 2003, filed the present patent application.

13. All acts set forth herein and/or relied upon for the purpose of establishing invention prior to April 28, 2003 were carried out in the United States.

14. I declare that all statements made herein of my knowledge are true and all statements made on information and belief are believed to be true. These statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under § 1001 of Title 18 of the United States Code. I understand that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: June 23, 2005

  
Isaac Farr

	<b>Invention Disclosure</b> (WKR <sup>P</sup> Document Number 20010517.135714)		<b>Done Printing</b>
	PD No. 10019128	Date Received by Legal 7/23/01	Managing Attorney Curtis Rose

The information contained in this document is **HP CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.

### General Information

**Write a descriptive title of the invention.**

Ink Level Sensing for Ink Supplies using the Electrical Double Layer Phenomenon Established within Conductive Polymers

**Write a brief abstract of the invention.**

An ink level sensor is disclosed which takes advantage of large capacitance differences in conducting polymers which are exposed to inks versus those that are not.

[REDACTED]

**Select product names or numbers associated with this invention.**

none

### Description of Invention

[REDACTED]

**Explain the problems solved by the invention.**

The improvement to the previously disclosed EDL method is a greater signal to noise ratio.

**What are the advantages of this invention over what has been done before?**

A greater signal to noise ratio will impact several factors, including:

cost-less material/space is needed for a required S/N

greater precision and accuracy

The EDL method requires that ink be in contact with two conductors. Material compatibility is a potential issue at this interface. The conductive coating can effectively isolate the conductor from corrosive ink components. The coating itself can be optimized by lightly crosslinking it to selectively reduce the level and type of absorbed ink components.

**Describe the construction and operation of the invention.**

The capacitance generated using the EDL mechanism is much greater than that for traditional capacitors. The high S/N ratio makes it a practical ILS method for inkjet supplies.

The current disclosure attempts to maximize the EDL effect by coating the surface of a conductor in contact with the ink with an electrically conducting polymer. The capacitance generated within the conductive coating is a function of the exposed surface to ink.

See e-file for theoretical description.

**Invention History**

**Was a description of the invention published, or are you planning to publish? If so, when and in what publications?**

No

**When was this invention published?**

**Describe the details of the publication of this invention**

**Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, when and where?**

No

**When was this invention announced, offered for sale, or sold?**

**Describe the details of the announcement of this invention.**

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

**Was the invention described in a lab book or other record?**

Yes

[REDACTED]



**Where, when, and how was this invention described?**

HP lab notebook#20662 p.24,25,27

**Was the invention built, modeled, or tested? If so, when?**

Yes

**When was this invention built?**

June 18, 2001

**Was the invention made under a government contract?****If so, the agency and contract number:**

No

**Give the agency and contract number:****Inventor Information****Pursuant to my (our) employment agreement, I (we) submit this disclosure:**

Employee Number	Location Code	Telnet	E-Mail	Site
Isaac Farr	[REDACTED]	[REDACTED]	[REDACTED]	Corvallis, OR, US

**Enter the home address of each inventor. This information is legally required to process your Invention Disclosure.**

Home Street Address	City	State or Province	Zip or Postal Code	Country
Isaac Farr	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

**Select the country of citizenship for each inventor.**

Citizenship
Isaac Farr United States [US]

**Type the HP Mail Stop for each inventor.**

Mail Stop
Isaac Farr [REDACTED]

**Please list the names, home addresses, telephone numbers, email addresses, and countries of citizenship of inventors who are not affiliated with HP.**  
  
[REDACTED]

**Witness Information**

This invention has been explained to and understood by the following witnesses (you must name at least two witnesses).

Steve Zhang  
Ray Walker

At what date was this invention first explained to and understood by each witness?

Steve Zhang  
Ray Walker

Date Understood

May 22, 2001

May 22, 2001

**Attachments**

Do you have electronic document files to upload? Please convert your documents into MS Word, PowerPoint, Adobe Acrobat, or plain text format.

File

Uploaded

EDL\_within\_a\_Conducting\_Polymer.ppt (PDF)

5/22/01 12:AM by Isaac Farr

Conductive\_Polymer\_Coating.ppt (PDF)

6/25/01 3:06PM by Isaac Farr

Do you have paper documents to include with your Invention Disclosure that you would like to send by FAX?

**Additional Information**

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

**Administrative Record****Select the name of the Patent Clerk(s) working on this Invention Disclosure:**

Michiko Isagawa

**Select the name of the Legal Admin(s) working on this Invention Disclosure:**

Trisha Melcher

**Record the PD number assigned by Merlin and modify the date this disclosure was received, if necessary.**

10019128

**Enter the legal received date:**

July 23, 2001

**Select the name of the Patent Coordinator(s) who will work on this Invention Disclosure:**

Jeffrey M Valley

**Select the name of the Managing Attorney(s) assigned to this Invention Disclosure:**

Curtis Rose

**Select a Legal Entity and Site where this Invention Disclosure will be handled and reviewed:**

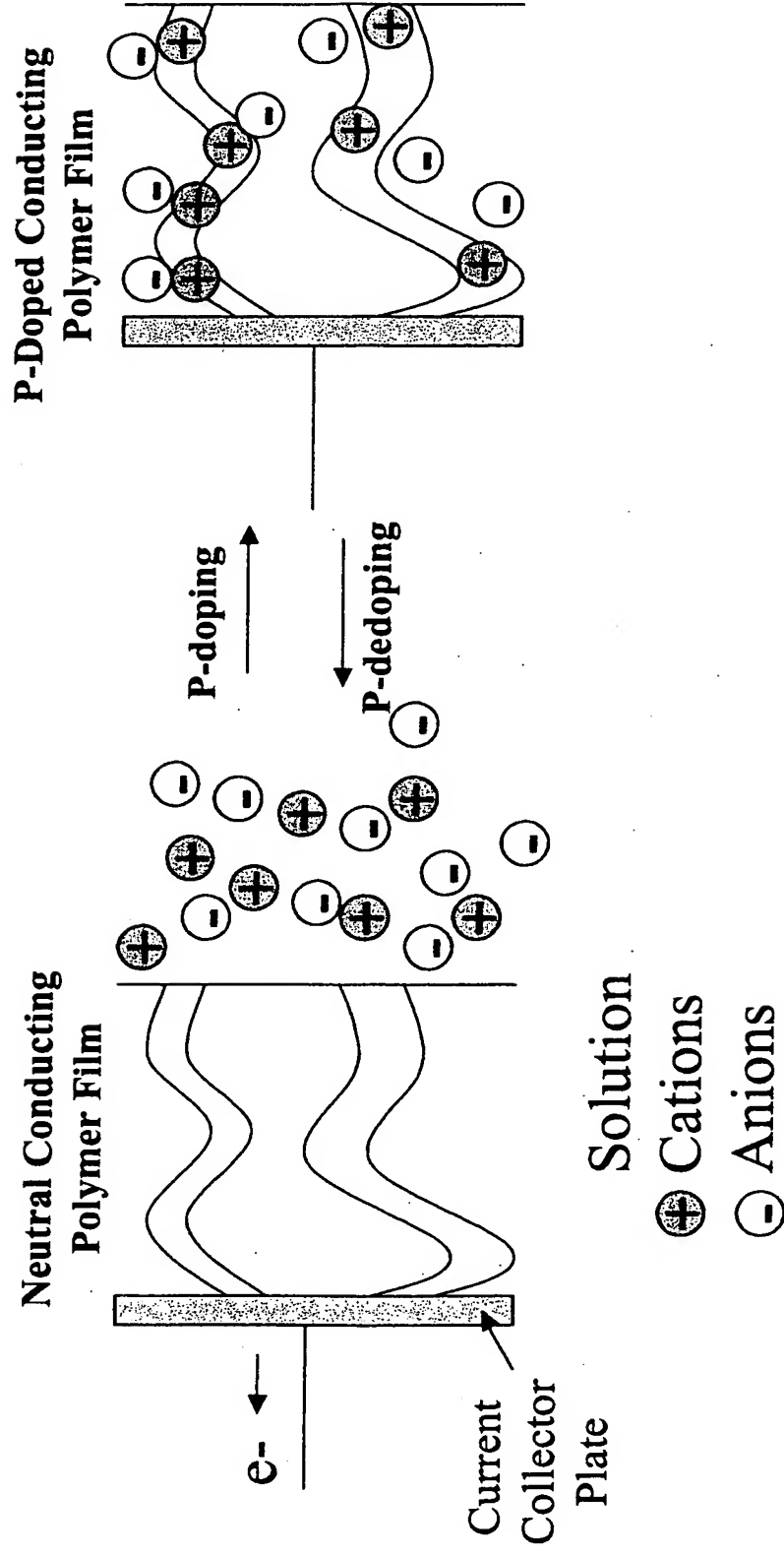
IJS

**Please select a Legal Site:**

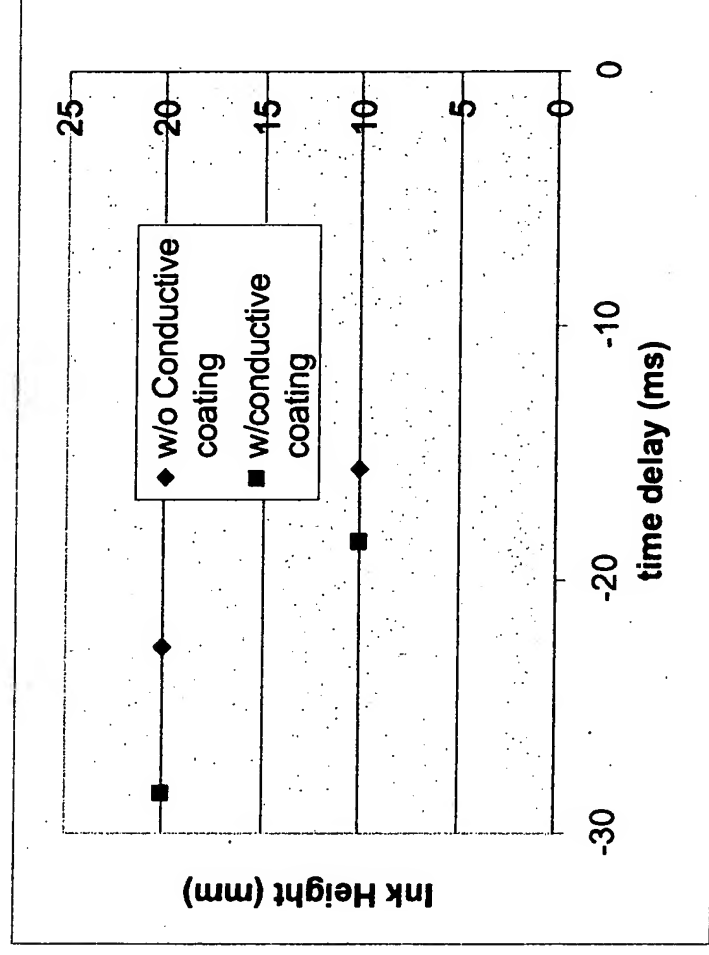
Corvallis




# Electrical Double Layer Formation within a Charged Conducting Polymer



# Increased Capacitance with Conductive Polymer Coating



- Stainless-steel probes served as the conductors (“w/o conductive coating”)
- Baytron P, a conductive coating, was dip coated onto the stainless-steel needles (“w/conductive coating”)

	<b>Invention Disclosure</b> (WKRP Document Number 20010618.154854)		<b>Done Printing</b>
	PD No. 10019148	Date Received by Legal 7/23/01	Managing Attorney Curtis Rose

The information contained in this document is **HP CONFIDENTIAL** and may not be disclosed to others without prior authorization. Submit this disclosure to the HP Legal Department as soon as possible. No patent protection is possible until a patent application is authorized, prepared, and submitted to the Government.

### General Information

**Write a descriptive title of the invention.**

A Chemically Compatible Conductive Coating/Tubing to Enable Out-of-ink Sensing in Inkjet Supplies

**Write a brief abstract of the invention.**

The key to enable an out-of-ink sensor based on conductivity or capacitance (EDL) is to protect the exposed conductive material from ink corrosion. An ink compatible material which can be made conductive, eg. Teflon, may be used as a coating or tube material for this end.

**Select product names or numbers associated with this invention.**

007 and Goldeneye

### Description of Invention

The prior art of measuring the presence of ink via conductivity required exposing a conductive metal directly to the ink. In the event the metal is incompatible with the ink, corrosion can take place and cause ink shorts, disabling the measurement device.

**Explain the problems solved by the invention.**

In order to isolate the conductor from the ink and its subsequent corrosion, it may be coated with an inert polymer which has been doped to make it conductive, eg. teflon. In addition, the inert-conductive material itself can be extruded or molded into a useful geometry.

**What are the advantages of this invention over what has been done before?**

The described solution will either eliminate or significantly reduce corrosion issues typically observed with metals.

A protective coating will potentially enable the use of inexpensive metals which might otherwise be ruled out due to their corrosion issues.

**Describe the construction and operation of the invention.**

Conductive coatings and tubing are commercially available. Our application in inkjet technology is a rather unique one, which can readily take advantage of these products.

The following is a quote from "Endura Coatings" on conductive coatings.

"Teflon® finishes can be successfully applied to most ferrous and non ferrous metals, steel, stainless steel, aluminum, copper, titanium & their alloys. Chemical & Corrosion Resistance: Teflon® coatings are inert to most chemicals, including acids, alkalies, halogens, metal salt solutions, solvents, and exhibit excellent corrosion resistance. Electrical Properties: Coatings are available from conductive to offering superior dielectric strength (typically to 1000 volts/mil)."

The following is a quote from "Antistatic Industries" on conductive tubing.

"StaticHose® is a conductive hose made from rubber, synthetic rubber (EPDM) or Teflon. StaticHose® can withstand harsh chemicals, ultraviolet rays and a wide range of temperatures."

**Invention History**

**Was a description of the invention published, or are you planning to publish? If so, when and in what publications?**

No

**When was this invention published?**

**Describe the details of the publication of this invention**

**Was a product including the invention announced, offered for sale, sold, or is such activity proposed? If so, when and where?**

No

**When was this invention announced, offered for sale, or sold?**

**Describe the details of the announcement of this invention.**

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

<b>Was the invention described in a lab book or other record?</b> Yes
<b>Where, when, and how was this invention described?</b> Lab notebook #20662, pg.26,3-19-2001
<b>Was the invention built, modeled, or tested? If so, when?</b> No
<b>When was this invention built?</b>
<b>Was the invention made under a government contract?</b> If so, the agency and contract number: No
<b>Give the agency and contract number:</b>

<b>Inventor Information</b>					
Pursuant to my (our) employment agreement, I (we) submit this disclosure:					
Employee Number	Location Code	Telnet	E-Mail	Site	
Isaac Farr				Corvallis, OR, USA	
Enter the home address of each Inventor. This information is legally required to process your Invention Disclosure.					
Home Street Address	City	State or Province	Zip or Postal Code	Country	
Isaac Farr					
Select the country of citizenship for each Inventor.					
Isaac Farr				Citizenship United States [US]	
Type the HP Mail Stop for each Inventor.					
Isaac Farr				Mail Stop 1023D	
Please list the names, home addresses, telephone numbers, email addresses, and countries of citizenship of inventors who are not affiliated with HP.					



**Witness Information**

This invention has been explained to and understood by the following witnesses (you must name at least two witnesses).

Eric S (Ric) Dod  
Ray Walker

At what date was this invention first explained to and understood by each witness?

Eric S (Ric) Dod  
Ray Walker

**Date Understood**

June 20, 2001

June 20, 2001

**Attachments**

Do you have electronic document files to upload? Please convert your documents into MS Word, PowerPoint, Adobe Acrobat, or plain text format.

Do you have paper documents to include with your Invention Disclosure that you would like to send by FAX?

**Additional Information**

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

**Administrative Record****Select the name of the Patent Clerk(s) working on this Invention Disclosure:**

Michiko Isagawa

**Select the name of the Legal Admin(s) working on this Invention Disclosure:**

Trisha Melcher

**Record the PD number assigned by Merlin and modify the date this disclosure was received, if necessary.**

10019148

**Enter the legal received date:**

July 23, 2001

**Select the name of the Patent Coordinator(s) who will work on this Invention Disclosure:**

Winthrop D Childers

**Select the name of the Managing Attorney(s) assigned to this Invention Disclosure:**

Curtis Rose

**Select a Legal Entity and Site where this Invention Disclosure will be handled and reviewed:**

IJS

**Please select a Legal Site:**

Corvallis

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**